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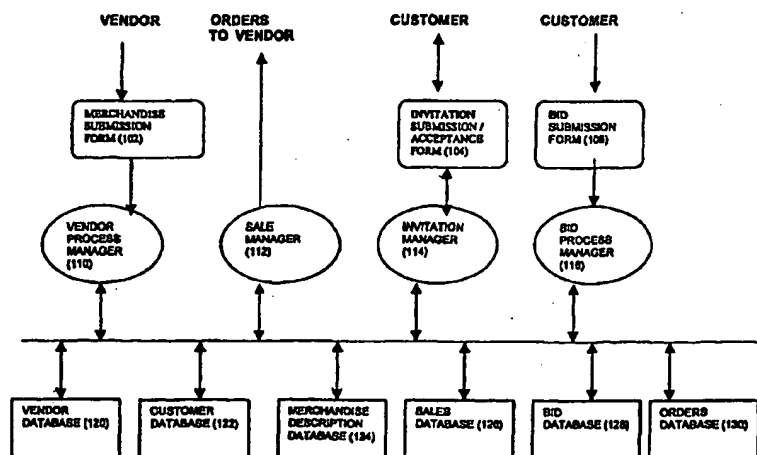
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(54) Title: **METHOD AND SYSTEM FOR LOW VOLUME BUYERS TO AGGREGATE PURCHASING POWER**



(57) Abstract

A method and system for low volume buyers to aggregate their purchasing power to gain high volume discounts. Vendors display information about their products and services along with a price schedule that provides greater discounts for bigger volume of purchases. For example, buying 1 unit costs \$100 per unit, 10 units would cost \$90 per unit, and 1000 units cost \$60 per unit. Another example of a volume discount is the price paid by each buyer is the total value demanded by the vendor divided equally between all interested buyers. Buyers then aggregate online to take advantage of these volume discounts. Unlike an auction model, where more buyers mean higher prices, here more buyers lead to lower prices.

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**Description**

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**METHOD AND SYSTEM FOR LOW VOLUME BUYERS TO AGGREGATE  
PURCHASING POWER**

**BACKGROUND OF THE INVENTION**

**Field of the Invention**

5           The present invention relates generally to electronic commerce and  
more particularly to forming temporary online communities to aggregate  
10           buying power and thereby reduce the purchase price of products of interest  
to the communities.

**Description of the Related Art**

10           Many vendors offer discounts for purchasing in high volumes.  
Typically the purchasing entity is a large corporation that is purchasing a  
20           high volume of a product either for its own consumption or to offer the  
product for sale to other entities who buy smaller units of the product. It is  
25           normally not possible for an individual buyer or a small company to avail  
15           itself of these high volume discounts.

          In the physical world, companies such as Sam's Club and Costco  
30           allow individuals and small companies to become members of their  
"purchasing club." Being a member of these clubs allows an individual to  
benefit from the purchasing power of the entire club membership. There  
20           are four important aspects to club membership. First, the membership is  
35           an up-front commitment, typically an annual membership with some  
nominal membership fee. Second, the membership allows the member a  
lower price on all the products carried by the Club-- that is, typically there  
40           is a price advantage over non-members for all products. Next, though a  
25           particular product may be offered by multiple vendors, the members do not  
get directly involved in negotiating with a particular vendor-- the Club  
45           negotiates the discount and each member decides whether he would like to  
buy the product or not at the stated price. Finally, since the negotiation is  
done directly by the Club, the members typically do not (and, indeed, have  
50           no reason to) coordinate their activities to decrease the price they pay for a

5 product. Thus, purchasers taking advantage of the available buying clubs  
are locked into a pre-defined arrangement and have no direct input into the  
10 choice of products offered or the discount available, nor are they able to  
coordinate their choices with other buyers.

## 5 SUMMARY OF THE INVENTION

To address the shortcomings of the available art, the invention  
15 allows buyers to aggregate their purchasing power to obtain volume  
discounts for specific products by using the Internet or a similar wide area  
network for buyers to coordinate purchasing of a given product and provide  
20 a communication and transaction medium for the buyers and the vendors.  
For example, an embodiment of the invention is a computerized system  
comprising: a) a Merchandise Submission Form to obtain sale information  
about a product from a vendor; b) a Bid Submission Form to obtain bid  
25 information for the product from a plurality of buyers; c) a Vendor Process  
Manager to store sale information in a Sale Database; d) a Bid Process  
Manager to store bid information in a Bid Database; and e) a Sale manager  
30 to match bid information and sale information and generate orders for the  
product. Preferably, the system provides that the vendor employ a volume  
discount price schedule. The system allows buyers to place and withdraw  
35 bids after the Start Time of the sale. After the Hold Time, only new bids  
and increased bids are allowed. Ideally, both the buyers and the vendor(s)  
communicate with the system via a wide area network such as the  
internet. However, other means of submitting and receiving information  
40 from the system are possible including automated telephone systems or  
even direct input and output, such as keyboard, monitor and printer.

In another embodiment, the system comprises a) Vendor Process  
45 means for obtaining sale information from a vendor about a product; b) Bid  
Process means for obtaining bid information for the product from a plurality  
of buyers; and c) a Sale means for matching bid information and sale  
50 information and generating orders for the product. The invention also is a

5 computer-implemented method comprising the steps of a) obtaining sale  
information about a product from a vendor; b) obtaining bid information for  
10 the product from a plurality of buyers; c) storing and organizing the sale  
information; d) storing and organizing the bid information; e) matching bid  
5 information and sale information; and f) generating orders for the product.  
The invention also comprises computer-readable media having instructions  
15 for carrying out the above steps.

#### **BRIEF DESCRIPTION OF THE DRAWINGS**

The aforementioned advantages of the invention, as well as  
10 additional advantages thereof, will be more fully understood as a result of a  
20 detailed description of a preferred embodiment when taken in conjunction  
with the accompanying drawings in which:

FIG. 1 is a schematic diagram of the inventive system including  
25 databases, managers, and input/output forms;

15 FIG. 2 is a flow chart illustrating the operation of the Vendor Process  
Manager of the present invention;

30 FIG. 3 is a flow chart illustrating the operation of the Bid Process  
Manager of the present invention;

FIG. 4 is a flow chart illustrating the operation of the Sale Manager  
20 of the present invention;

35 FIG. 5 is a flow chart illustrating the operation of the Invitation  
Manager of the present invention.

40 While the invention is susceptible to various modifications and  
alternative forms, specific embodiments thereof have been shown by way  
25 of example in the drawings and will herein be described in detail. It should  
be understood, however, that the detailed description is not intended to  
45 limit the invention to the particular forms disclosed. On the contrary, the  
intention is to cover all modifications, equivalents, and alternatives falling  
within the spirit and scope of the invention as defined by the appended  
30 claims.

**DETAILED DESCRIPTION OF THE INVENTION**

In a preferred embodiment of the present invention, the sale process is divided into three time periods. Once a vendor has submitted information about a product, it is assigned a "Start Time," a "Hold Time" and a "Close Time". After the Start Time, buyers are free to place bids for the product. At the Close Time, any valid bids are processed and the product is sold at the price dictated by the number of bids. The Hold Time freezes a maximum price for the product by requiring users who have an open bid at the Hold Time to honor that bid. After the Hold Time users cannot withdraw or decrease their bids, although they may increase it or add a new bid. Until the Hold Time, the user has complete freedom. Any buyer who had indicated an interest in the product can decide to increase the number of units being bid for, introduce a new bid, decrease the number of units being bid for, or withdraw a bid completely.

Multiple vendors are invited to publish a description of the products they offer along with a price schedule that offers the price for a particular volume of the product. For example, a vendor could state a price schedule as illustrated in Table 1:

Number of units purchased at one time	Price per unit
1	\$100
5	\$95
10	\$85
50	\$75
100	\$65
1000+	\$50

Table 1

The above price schedule is quite typical, and might apply to products such as computers, books, CDs, and airline tickets, to name just a few.

5 In another example, the vendor desires \$10,000 for an amount of  
product up to a set maximum. The vendor specifies, for example, a  
maximum of 5,000 buyers. Accordingly, the price per buyer is \$10,000  
10 divided by the number of buyers up to a maximum of 5,000. While this  
5 price schedule is currently not in much use, in the future it could be used  
as a means of selling products with a fixed cost of production and small or  
almost zero distribution costs. Examples of such products are research  
15 reports, music recordings, films, sporting events, and software. Without  
the method and system of the present invention, it would not be possible  
10 for a vendor to sell a product directly to the consumer using such a price  
20 schedule.

The vendor then sets the time frame for the sale by stating that the  
sale will open at Start Time and end at Close Time. The total number of  
25 buyers registered for the sale at Close Time would be aggregated and the  
15 final sale price for the product would be computed based on the total  
number of units for which the buyers have placed an order.

30 As shown in FIG. 1, one embodiment of the invention comprises a  
computer system comprising a number of software modules that generally  
include Forms that allow the input of information from vendors and buyers,  
20 Databases that organize and process the buyer and vendor information, and  
35 Managers that communicate the information between the Forms and the  
Databases.

Specifically, the Forms comprise: Merchandise Submission Form  
40 102, which enables vendors to submit information about the products they  
25 want to offer; Invitation Submission/Acceptance Form 104, which enables  
buyers to invite others to the system and invited buyers to accept the  
45 invitation; and Bid Submission Form 106, which enables buyer to submit  
bids.

The Managers process and control the flow of information from the  
30 Forms and the Databases and comprise: Vendor Process Manager 110,



5 which controls the products placed for sale by a vendor; Sale Manager  
112, which controls the initiation and the closing of a sale; Invitation  
10 Manager 114, which controls the invitation of other potential buyers to join  
the bidding process for a particular product; and Bid Process manager 116;  
5 which controls the buyer's bids for a particular product being offered for  
sale. Functional details of the Managers are shown in FIGs. 2-5 and  
15 described below.

The Databases process the product, vendor and bid information and  
comprise: Vendor Database 120, which stores information about all the  
10 participating vendors; Customer Database 122, which stores information  
20 about all the customers registered to participate in online purchasing;  
Merchandise Description Database 124, which stores information about  
each product offered for sale; Sales Database 126, which stores  
25 information about each sale known to the system; Bid Database 128,  
15 which stores all the bids registered by customers for each sale; and Orders  
Database 130, which stores orders at the consummation of a Sale.

30 The operation of Vendor Process Manager 110 is illustrated by flow  
chart in FIG. 2. Generally, a vendor uses Merchandise Submission Form  
102 to submit information to Vendor Process Manager 110 to first register  
20 himself, if he or she is not already registered. The vendor then submits  
35 product information to be stored in the system. These functions are  
outlined by the following steps. At step 201, the system checks to see if  
the vendor is registered. This step also authenticates the vendor's identity.  
40 Various methods of identifying a vendor are envisioned, including reading  
25 the vendor's network address, and other methods that will be known and  
understood by those skilled in the art to which the present invention  
pertains. At step 202, the vendor submits identifying information and  
45 registers with the system if the vendor is currently not registered with the  
system. At step 203, Vendor Process Manager 110 processes information  
50 from Merchandise Submission Form 102. Specifically, the information is

5 checked for validity and completeness, including ensuring that the vendor  
provides a volume-based price schedule for the product. If the vendor fails  
10 to provide a volume discount or if the information is incomplete or  
otherwise incorrect, at step 204 the vendor is notified of the error and  
5 prompted to correct the information. At step 205 the verified merchandise  
description is forwarded to Merchandise Description Database 124. Finally,  
15 at step 206 the Sales Database 126 is updated with a new sale record  
containing information about the sale of the new merchandise just added to  
the Merchandise Description Database 124.

20 FIGs. 3A and 3B are flow charts illustrating the operation of Bid  
Process Manager 116, allowing a prospective buyer to register his interest  
in purchasing a particular product offered for sale by placing a bid for the  
product. FIG. 3A illustrates that at step 301 the system checks the  
25 prospective buyer to see whether he or she is registered with the system.  
15 This also includes any authentication steps to verify the customer's  
identity. Preferably, this could be accomplished using automated  
identification and authentication processes, as will be understood by those  
30 skilled in the art. New customers are registered by submitting the requisite  
information at step 302. At step 303, the customer's instruction to place  
20 a new bid in the sale or to increase the number of units in an existing bid is  
processed if the current time is between the Start Time and the Close  
Time. Instructions to decrease a bid or withdraw it altogether are  
35 processed at step 304 by checking to see whether the Hold Time for the  
sale has occurred. At step 305, an error message is returned to the  
40 customer if the Hold Time for the sale has passed, informing the customer  
25 that the bid cannot be deleted or reduced. If the Hold Time has not  
passed, the customer's bid is deleted or reduced at step 306 accordingly,  
45 and Bid Database 128 is updated.

At step 307, Bid Process Manager 116 computes a new price based  
50 30 on the change in bid reflected after step 306. If the user submits a bid

5 identifying the product name and the number of units desired, the price is  
obtained by adding up the total number of units requested so far and using  
10 the vendor's price schedule to calculate the current price. Thus, if 120  
units have been requested so far and the vendor is offering a price schedule  
5 including 100-120 units for \$5.50, then the current price is \$5.50 per unit.

If the user submits a bid including product name, number of units  
15 desired, and maximum bid price, then the price is obtained by: (i)  
calculating the total number of units desired thus far; (ii) using the vendor's  
price schedule to determine the current price; (iii) identifying all bids  
10 (matching bids) having a higher maximum bid price than the current price;  
20 (iv) computing the total number of units requested by the matching bids  
and using the vendor's price schedule to find out what the vendor's price  
would be for that volume; (v) if the price obtained from step (iv) is the  
25 same as the current price, then the current price is accurate, if not, then  
15 current price is set to the price computed in step (iv) and steps (iii) to (v)  
are repeated; finally, all bids identified in step (iii) at the termination of the  
30 process are the successful bids so far, and the price they would pay is the  
"current price" computed in step (v). If there are no successful bids at the  
conclusion of this process, then the current price is simply the list price.

20 New or increased bids processed at step 303 are verified at step  
35 308, including checking to see whether the bid refers to the product  
offered in the sale, and if the quantity requested is currently available. The  
system returns an error message at step 309 if the bid is not validated at  
40 step 308. Conversely, as shown in FIG. 3B, validated bids are added to Bid  
25 Database 128 in step 310 and Bid Process Manager 116 computes a new  
price based on the changed quantity of bids in step 311.

45 FIGs. 4A and 4B illustrated in flow chart form the operation of Sale  
Manager 112, thereby including the steps taken to initiate a new sale and  
process the sale until through close. At any one time, every sale in Sale  
30 Database 126 is in one of four states: New, Active, Hold, or Closed. New

5 sales are added to Sales Database 126 based on the information obtained  
through Merchandise Submission Form 102 to Vendor Process Manager  
110 as described above. Sale Manager 112 controls the process by which  
10 a new sale becomes Active, Held, or Closed.

5 Specifically, FIG. 4A shows that in step 401, Sale Database 126 is  
queried for all new sales whose Start Time is at or past the current time.  
15 At step 402, all such sales are marked as Active. In step 403, Active sales  
are communicated to prospective buyers, preferably through a wide area  
network such as the internet.. This includes retrieving the corresponding  
20 merchandise description information from Merchandise Description  
Database 124 and combining that information with the sale information,  
formatting all of it appropriately, putting the final description through an  
approval process that may be automated, and then publishing the  
25 information on the web.

15 At step 404, Sale Manager 112 queries Sale Database 126 for all  
Active sales with a Hold Time at or before the current time. At step 405,  
30 the appropriate sales are marked as Held, locking in the minimum number  
of bids. At step 406, the Sale database is queried for all Held sales with a  
Close Time that is at or past the current time, and those found are marked  
20 as Closed in step 407 such that no increases or new bids will be accepted.

FIG. 4B shows the steps taken to close out a sale. At step 408,  
Closed sales are identified and, and step 409, queries are made of Bid  
Database 128 for all outstanding bids corresponding to the Closed sale. At  
40 step 410, the final sale price is recomputed in a manner based upon the  
25 number of bids and the volume-based price schedule given by the vendor.  
At step 411, the product vendor's information is obtained from the Vendor  
Database 120 and a purchase order is constructed for each customer  
45 whose bid remained outstanding at the end of the sale. The purchase order  
will state the number of units bid by the customer and the unit price will be  
30 the price calculated at step 410. At step 412, the processed bids are

5 deleted from Bid Database 128 and new orders created at step 411 are  
added to Orders Database 130. Finally, at step 413, the processed sale is  
10 deleted from Sale Database 126 and, at step 414, the process returns to  
step 408 until all closed sales are processed.

5 A flow chart for the operation of Invitation Manager 114 is provided  
in FIG. 5. Generally, customers invite other users to join the system and  
15 bid on products. Since the invention is predicated on the aggregation of  
buying power, it is in the interests of the buyers to recruit as many new  
buyers as possible. Potential users wishing to accept the invitation use  
20 Invitation Manager 114 to do so. The system routes the processes to one  
of two paths at step 501: steps 502-506 control an invitation sent from a  
current user to a prospective one, while steps 507-509 allow a prospective  
user to accept an invitation.

25 Current users wishing to issue an invitation are first checked at step  
15 502 to determine if they are registered. If not, they are registered and  
added to Customer Database 122 at step 503. At step 504, the system  
checks to see whether the invitation is valid. Invitation validity may be  
30 determined in a manner dependant upon the prevailing policies in the  
system, such as that a customer must invite another user to a specific sale  
only, or that no more than five users may be invited at any given time, or  
35 that the customer must fill out certain pieces of information about each  
user being invited to join. At step 505, an error message is returned if the  
invitation is not validated at step 504. Valid invitations are formatted and  
40 then communicated to the desired prospective users at step 506. Suitable  
25 means of communication include email, fax, web-posting, postal mail and  
the like.

45 Invited users are checked at step 507 to determine whether they are  
in Customer Database 122. If the invitee is already a registered customer,  
then Invitation Manager 114 simply reminds the user. Alternatively, at step  
50 30 508 the requisite information is obtained and the invitee is added to

5 Customer Database 122, thereby registering the user. Preferably, suitable identification of the invitor to the record of the invitee at step 509.

10 The present inventive system and method for aggregating buyers can be implemented in a number of ways. Different ways have different  
5 advantages and disadvantages, but any one of these approaches would afford a low volume buyer the opportunity to gain high volume discounts.

15 The invention differs from a typical purchasing club in the following ways. First, the buyer is not necessarily required to make an up-front commitment or execute an annual contract with any entity. A buyer who  
20 discovers an interest in a particular product can decide to register at that time and place his bid for the product. Second, the aggregation of purchasing power is for a specific product being bid on and not necessarily for all the products being offered at any given time. For a specific product,  
25 the bidding buyer has an opportunity for volume discounts based on how many other people bid for the product. Next, there is no intermediary or other entity that negotiates on behalf of the buyers. Multiple vendors may  
30 offer the same product and buyers place a bid with different vendors. The aggregation of their orders with a specific vendor as opposed to another vendor is the forum by which buyers directly negotiate how they wish to  
35 purchase a particular product. Finally, since the final price paid for a product depends entirely on the action of the temporary buying community that is created online, there is every reason for buyers to coordinate their actions. In fact, buyers may invite other prospective buyers who may not  
40 be aware of the existence of this vendor or product to join the community.  
25 This coordinated buying effort has a direct impact on the final price paid by the temporary buying community for that product.

45 The invention has significant differences from other e-commerce approaches. For example, in standard e-commerce a vendor places products for sale, usually with just one price. An interested buyer can  
50 purchase the product online. Even in the cases that a vendor posts a

5 volume based price schedule, it is always meant to apply to a single buyer  
who may buy multiple units to take advantage of the volume discount. This  
10 approach to e-commerce does not address how a low volume buyer can  
take advantage of the volume discount without having to personally buy  
5 more units of the product. In another example, the Internet has popularized  
auction sites. Typically, multiple buyers bid competitively against each  
15 other for a given product. Under this model, the aggregation of buyers  
actually increases prices. In contrast, the invention described here lowers  
prices by aggregating buyers.

20 10 The present invention therefore provides a novel method and system  
for low volume buyers to aggregate purchasing power to gain high volume  
discounts. Although the present invention has been shown and described  
with respect to preferred embodiments, various changes and modifications  
25 lie within the spirit and scope of the claimed invention. For example, items  
15 bid upon need not be intended for immediate delivery, but may instead be  
for a contract to take deliver of an amount of product over a period of time,  
such as a five percent discount for 1000 tons of product over three years  
and a ten percent discount for 2000 pounds of product over three years.  
The vendor may further require a minimum tonnage requirement over a  
35 20 specified time period to bid, and discounts may vary based on any of the  
variables – such as amount, time to delivery, or price. Thus, the  
corresponding structures, materials, acts, and equivalents of all means or  
step plus function elements in the claims are intended to include any  
40 structure, material, or acts for performing the functions in combination with  
25 other elements as specifically claimed.

## Claims

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**What is claimed is:**

1. A computerized system for aggregating purchasing power comprising:

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- a) a Merchandise Submission Form to obtain sale information about a product from a vendor;
- b) a Bid Submission Form to obtain bid information for the product from a plurality of buyers;
- c) a Vendor Process Manager to store sale information in a Sale Database;
- d) a Bid Process Manager to store bid information in a Bid Database; and
- e) a Sale manager to match bid information and sale information and generate orders for the product.

25

2. The computerized system of claim 1 wherein the Vendor Process Manager requires a volume discount price schedule.

3. The computerized system of claim 1 further comprising an Invitation Manager to issue buying invitations to prospective buyers and accept buying invitations from prospective buyers.

30

4. The computerized system of claim 3 further comprising an Invitation Submission/Acceptance Form to obtain information for the Invitation Manager.

35

5. The computerized system of claim 1, wherein the Bid Process Manager allows new bids, increased bids, decreased bids and withdrawn bids for the product between a Start Time and a Close Time.

40

6. The computerized system of claim 4, wherein the Bid Process Manager prevents decreased bids and withdrawn bids after a Hold Time occurring between the Start Time and the Close Time.

45

7. The computerized system of claim 1, wherein buyers and the vendor submit and receive information from the computerized system by way of a wide area network.

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5                   8.     The computerized system of claim 7, wherein the wide area  
network comprises the internet.

10                   9.     The computerized system of claim 1, further comprising a  
Merchandise Description Database to store product information and a  
5 Vendor Database to store vendor information obtained from the  
Merchandise Submission Form.

15                   10.    A computerized system for aggregating purchasing power  
comprising:

                  a)     Vendor Process means for obtaining sale information  
20                   from a vendor about a product;

                  b)     Bid Process means for obtaining bid information for the  
product from a plurality of buyers; and

                  c)     a Sale means for matching bid information and sale  
25                   information and generate orders for the product.

15                   11.    The computerized system of claim 10 wherein the Vendor  
Process means requires a volume discount price schedule.

30                   12.    The computerized system of claim 10 further comprising an  
Invitation means for issuing buying invitations to prospective buyers and  
accepting buying invitations from prospective buyers.

35                   20           13.    The computerized system of claim 10, wherein the Bid  
Process means further comprises means to allow new bids, increased bids,  
decreased bids and withdrawn bids for the product between a Start Time  
and a Close Time.

40                   14.    The computerized system of claim 13, wherein the Bid  
25                   Process means prevents decreased bids and withdrawn bids after a Hold  
Time occurring between the Start Time and the Close Time.

45                   15.    The computerized system of claim 10, wherein the Bid  
Process means and the Vendor Process means transmits information  
between the system and the vendor and the buyers over a wide area  
50                   30           network.

5           16. The computerized system of claim 15, wherein the wide area network comprises the internet.

10           17. A computer-implemented method for aggregating purchasing power comprising the steps of:

5           a) obtaining sale information about a product from a vendor;

15           b) obtaining bid information for the product from a plurality of buyers;

          c) storing and organizing the sale information;

10           d) storing and organizing the bid information;

20           e) matching bid information and sale information; and

          f) generating orders for the product.

25           18. The method of claim 17, wherein the step of obtaining sale information further comprises obtaining a volume discount price schedule.

15           19. The method of claim 17, further comprising the steps of obtaining invitation information about prospective buyers and issuing invitations to the prospective buyers.

30           20. The method of claim 17, wherein the step of obtaining bid information allows new bids, increased bids, decreased bids and withdrawn bids for the product between a Start Time and a Close Time.

35           21. The method of claim 20, wherein the step of obtaining bid information prevents decreased bids and withdrawn bids after a Hold Time occurring between the Start Time and the Close Time.

40           22. The method of claim 17, wherein buyers and the vendor submit and receive information from the computerized system by way of a wide area network.

45           23. A computer-readable medium containing instructions for controlling a computer to aggregate purchasing power by:

50           a) obtaining sale information about a product from a vendor;

5                   b)     obtaining bid information for the product from a plurality  
of buyers;

                  c)     storing and organizing the sale information;

10                  d)     storing and organizing the bid information;

5                   e)     matching bid information and sale information; and

                  f)     generating orders for the product

15                  24.    The computer-readable medium of claim 23, wherein the  
instructions for obtaining sale information further comprise obtaining a  
volume discount price schedule.

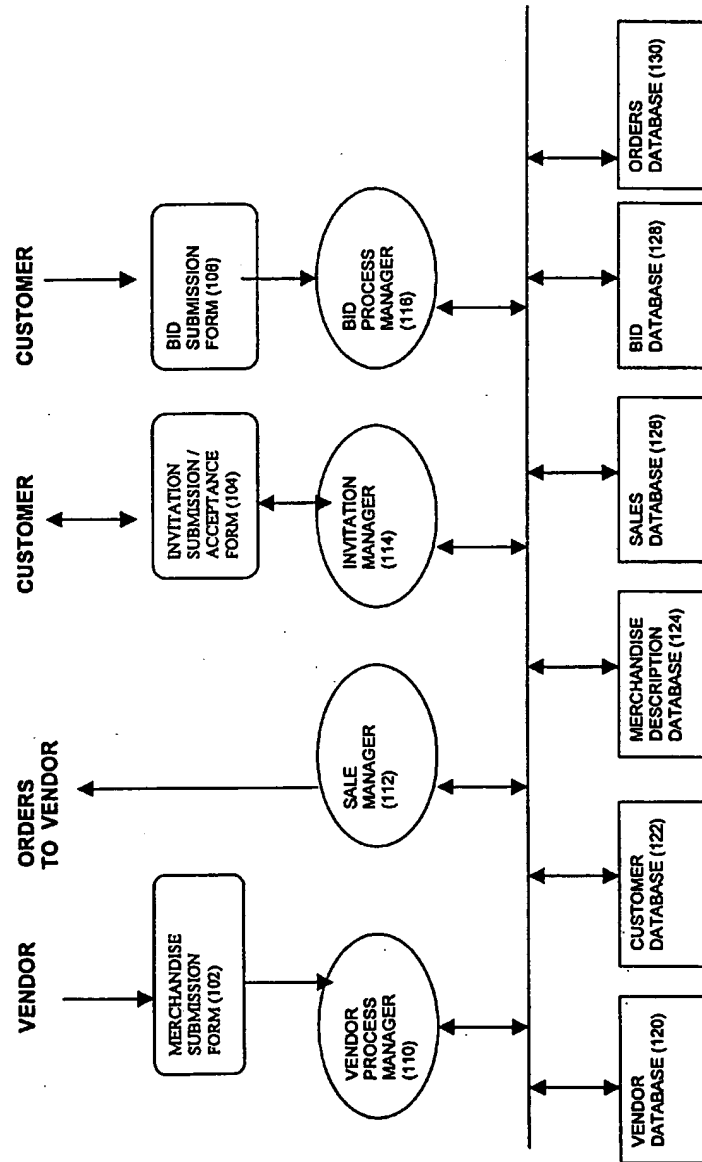
20                  25.    The computer-readable medium of claim 23, further  
comprising instructions for obtaining invitation information about  
prospective buyers and issuing invitations to the prospective buyers.

25                  26.    The computer-readable medium of claim 23, wherein the  
instructions for obtaining bid information allow new bids, increased bids,  
15    decreased bids and withdrawn bids for the product between a Start Time  
and a Close Time.

30                  27.    The method of claim 26, wherein the instructions for  
obtaining bid information prevent decreased bids and withdrawn bids after  
a Hold Time occurring between the Start Time and the Close Time.

35                  28.    The computer-readable medium of claim 23, further  
comprising instructions for storing product information and for storing  
vendor information.

Fig. 1.



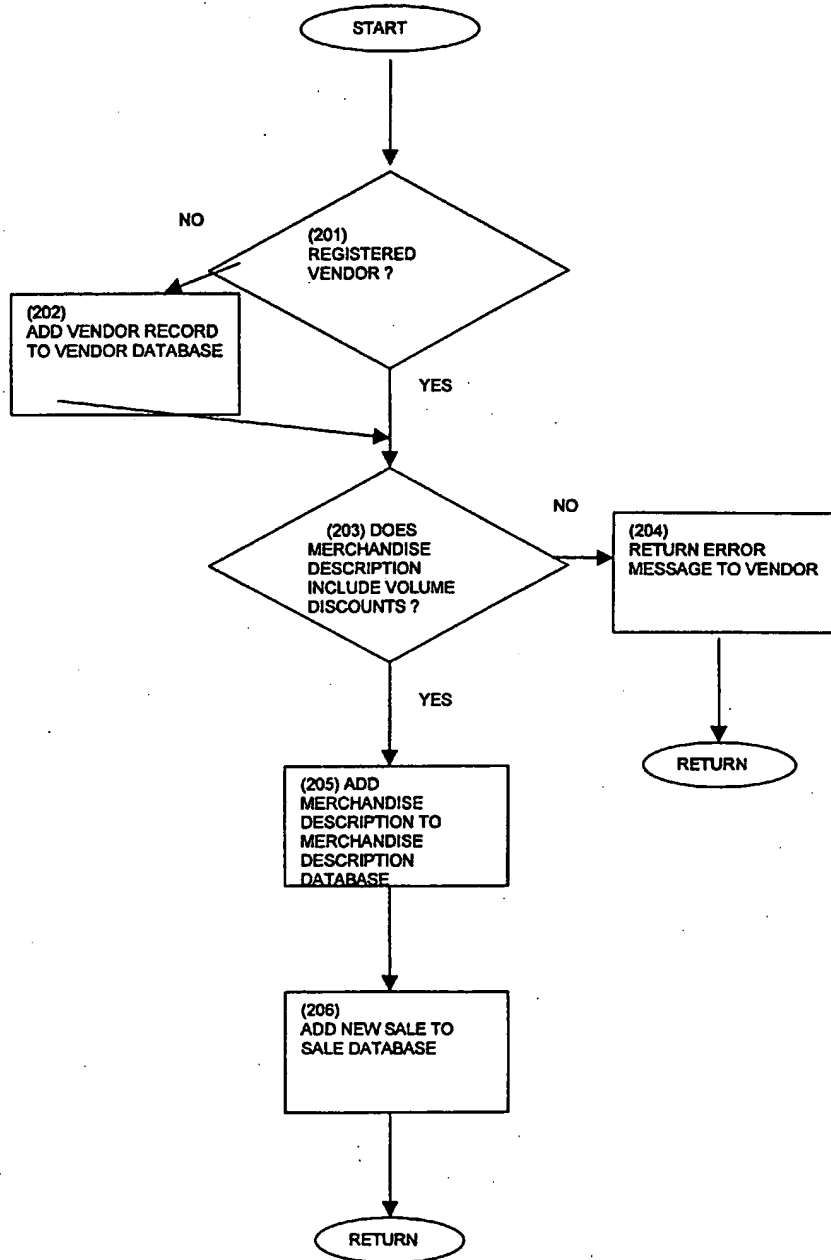
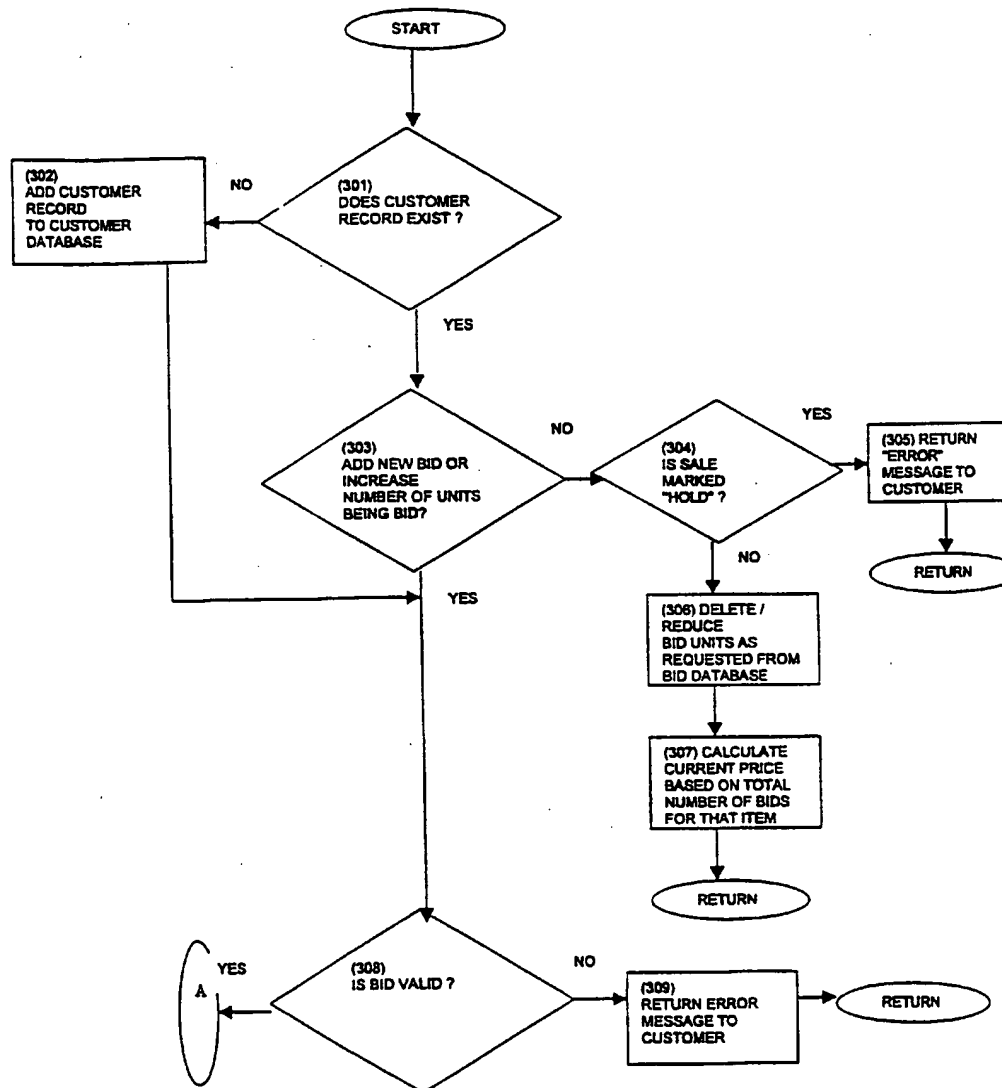
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Fig. 2

Fig. 3A.



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Fig. 3B.

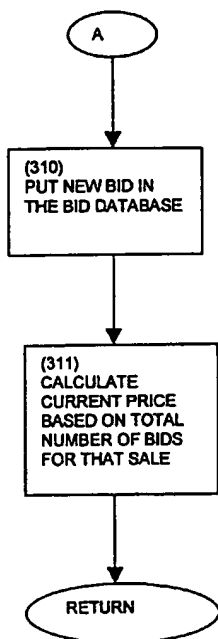
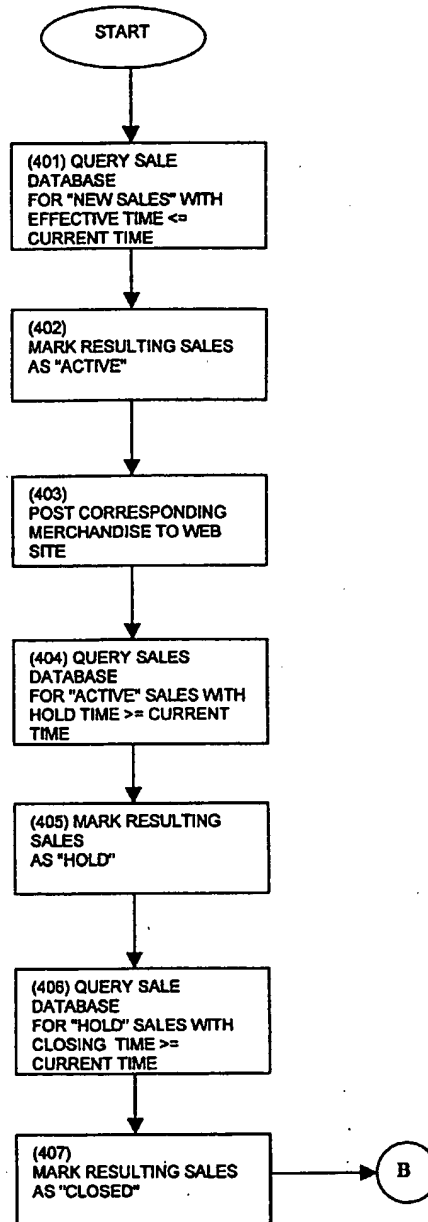




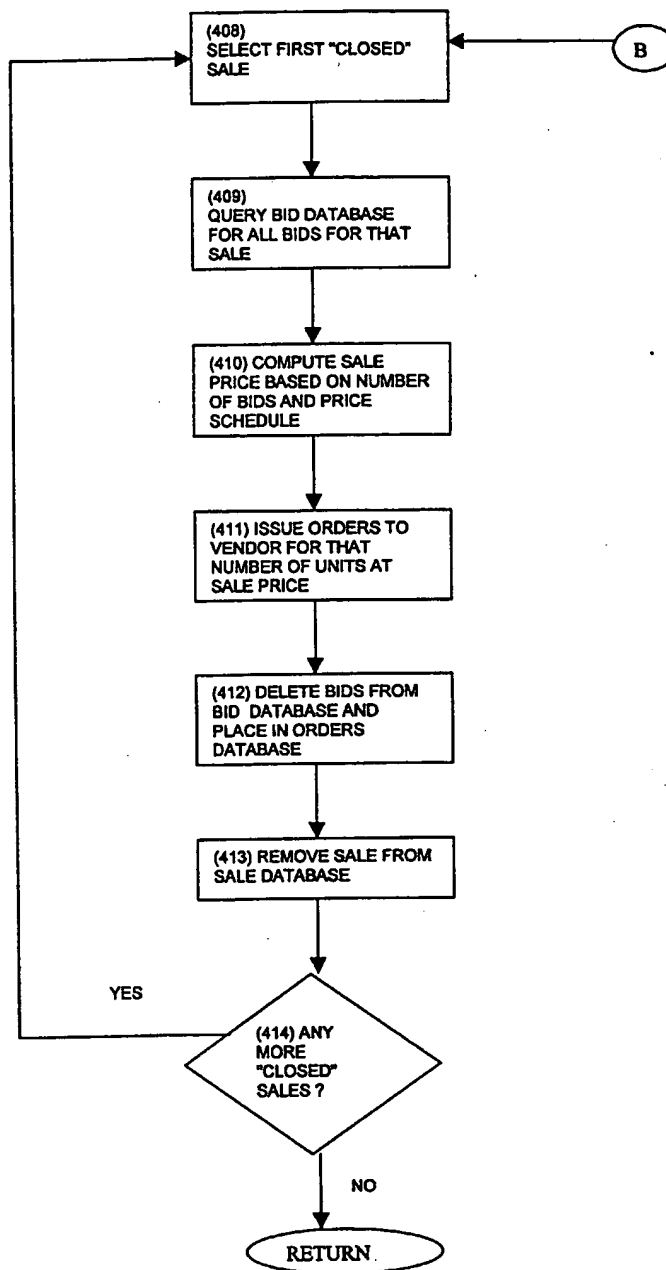
Fig. 4A.

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Fig. 4B.



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Fig. 5.

